U.S. DEPARTMENT OF THE INTERIOR
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

AUGUST 2001 FIRE COMPLEX

SOIL AND WATERSHED RESOURCE ASSESSMENT

I. OBJECTIVES

- Assess fire-caused changes in watershed conditions.
- Develop a map of burn severity.
- Identify potential flood and erosion source areas.
- Identify potential threats to life, property, cultural and natural resources in relation to flood and erosion source areas.
- Develop treatment recommendations if necessary.
- Identify future monitoring needs.

II. ISSUES

- Potential threats to human life and property within and downstream of the fires from potential increases in storm flow runoff and flooding or debris flows.
- Changes in water quality.
- Potential loss of soil productivity and increased erosion.

III. OBSERVATIONS

A. Background

1. Geology/Physiography:

The August 2001 Fire Complex consists of 13 fires totaling 259,165 acres within the Owyhee High Plateau Major Land Resource Area (MLRA) with a smaller portion of the fires occurring within the Humboldt Area MLRA. The Owyhee High Plateau MLRA surrounds Elko, Nevada and extends to the northeast corner of the state encompassing most of Elko county. The Humboldt MLRA is west and southwest of Elko, Nevada encompassing most of Humboldt county and portions of Lander and Eureka counties. Elevations in the area range from approximately 4,000 to more than 9,835 feet.

Within both the Owyhee High Plateau MLRA and the Humboldt Area MLRA are widely-spaced, north-south trending mountain ranges with steep slopes that are separated by broad valleys bordered by smooth, gentle alluvial slopes. Mountain slopes are underlain by both volcanic and sedimentary rocks. Valley floors are underlain by Pleistocene lake sediments and recent alluvium.

In the uplands, the volcanic materials vary from basaltic to intermixed ash and tuffaceaous materials. Sediments include erosion-resistant, consolidated silicious materials and conglomerates, as well as limestone, shale, and sandstone, with some layers of erodible bentonite clay. Debris flows and recent alluvial deposits in channels and foothills include a range of particle sizes from very coarse (boulders, stones, and cobbles) to very fine clays in wide flat valley bottoms.

2. Climate:

The area surrounding Elko, Nevada is an arid climate with low relative humidity, high evaporation and abundant sunshine. Summers are hot with average monthly maximum temperatures of 91 degrees Fahrenheit and extremes above 105 degrees. Winters are cold with average monthly maximum temperatures of 37 degrees Fahrenheit and extremes below -40 degrees.

Precipitation is strongly orographically controlled. Rain shadows to the east of the north-south trending mountain ranges are places of notable low precipitation. The average annual precipitation in Elko, Nevada is 10 inches and is evenly distributed throughout the year. In surrounding areas precipitation varies from 5 inches in the valleys to 20 inches on the higher mountain ranges. Average seasonal snowfall is 28 inches.

3. Hydrology:

Surface waters in the August 2001 Fire Complex drain two major hydrographic basins. They are the Snake River Basin and the Humboldt River Basin. The Snake River Basin drains into the Snake River which is tributary to the Columbia River. The Humboldt River Basin is an enclosed drainage basin. It drains into the Humboldt River which terminates in the Humboldt Sink.

Perennial streams within the August 2001 Fire Complex drain large mountain watersheds. Peak runoff for these streams occurs from April to May as the snowpack begins to melt in the higher elevations. Low flows occur beginning in late September/early October.

B. Reconnaissance Methodology and Results

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions and if there are values at risk from these conditions. If an emergency is not identified, the assessment stops. If emergency watershed conditions are found, and values at risk are identified, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are analyzed, and treatment prescriptions are developed to protect values at risk. Emergency watershed conditions include both hydrologic and soil factors; typically potential for flash floods and debris flows and deterioration of soil condition, particularly loss of soil cover, leading to a decline in soil productivity. Table 2 describes terms commonly used in assessing soils and watersheds that have been burned.

Table 1. Definitions of terms commonly used in soil and watershed burned area assessments.

Term	Definition
Fire Intensity	Based on temperature, flame length, rate of spread, heat of combustion and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects to the overstory.
Fire Severity	Based on temperature, moisture content of duff and fuels lying on the ground, heat of combustion of conductive and radiant heat that goes down in to the soil, affecting soil characteristics.
Burn Severity	A relative measure of the degree of change in a watershed that relates to the severity of the effects of the fire on soil hydrologic function. Burn severity is delineated on topographic maps as polygons. Classes of burn severity are high, moderate, low and unburned.
Watershed Response	A qualitative degree and/or modeled measure of how a watershed will respond to precipitation. Parameters include pre-existing soil moisture; amount of soil cover; amount and distribution of impermeable surfaces (rock outcrop, hydrophobic soils); amount and duration of rainfall; lag time between initiation of storm and peak flow runoff; and peak flow discharge and sediment yield. Changes in the characteristics of a watershed brought about by a fire will increase the efficiency with which a watershed yields runoff.

Field visits, direct soil observations, and helicopter reconnaissance were conducted to identify the spatial distribution and extent of fire intensity and soil burn severity conditions. Burned area evaluations included, but were not limited to:

- Fire-caused changes in soil properties and hydrologic function.
- Aerial extent and strength of hydrophobic soil conditions.
- Mapping burn severity.
- Conditions of sediment source areas.
- Current channel and culvert capabilities.
- Threats to human life, property and critical cultural or natural resources from storm or mudflow and debris.

1. Burn Severity:

Burn severity is not the same concept as fire intensity and fire severity as recognized by fire behavior specialists. Fire intensity and fire severity relate to fire behavior and fire effects on overstory and understory vegetation, respectively, while burn severity relates specifically to effects of the fire on soil conditions and hydrologic function (e.g., amount of surface litter and duff, erodibility, soil structure, infiltration rate, runoff response). Although burn severity is not primarily a reflection of fire effects on vegetation, vegetative conditions and pre-fire vegetation density are among indicators used to assess burn severity.

Site indicators used to evaluate and map burn severity include soil hydrophobicity (water repellency), ash depth and color (fire severity), size of residual fuels (fire intensity), soil texture and structure, and post-fire effective ground cover. These criteria provide clues

about fire residence time, depth of litter layer consumed, radiant heat throughout the litter layer and ease of detachability of the surface soil. Using these indicators, burned areas are mapped into three relative burn severity categories - high, moderate, and low. A category of "unburned" may be mapped separately if there are large unburned islands inside the burn perimeter. Alternatively, mosaics of low and unburned areas may be lumped together for mapping and assessment purposes.

In some cases there may be complete consumption of vegetation by fire, with little effect on soil and watershed function. In general, the denser the pre-fire vegetation and the longer the residence time, the more severe the effects of the fire are on soil hydrologic function. For example, deep ash after a fire usually indicates a deeper litter layer prior to the fire, which generally supports longer residence times.

Increased residence time promotes the formation of water repellent layers at or near the soil surface, and loss of soil structural stability. The results are increased runoff and soil particle detachment by water and transport off-site (erosion). The presence of white ash can indicate a hotter fire and more complete consumption of organic matter. Powdery ash without identifiable remnants of twigs and leaf litter also indicates more complete consumption. Generally there is a close correlation between soil properties and the amount of heat experienced by the soil as well as the residence time of the heat in contact with the soil.

The burn severity map becomes a basis to predict the hydrologic response of soil as a result of the fire and the rate of natural revegetation of the site following the fire. It is important to note that burn severity polygons are usually mapped at no less than 40 acres in size and may include areas of other burn severity, which are too small to segregate. Small areas of different burn severity can therefore be present in each map unit.

2. Soil Condition:

Fire effects were evaluated in terms of soil condition parameters. These parameters included changes in litter and duff (vegetative ground cover), loss of soil structure, destruction of fine and very fine roots in the surface horizon, susceptibility to erosion, and development of hydrophobic (water repellant) soil surfaces. Changes in vegetative ground cover as affected by the fire were noted and compared to pre-fire conditions. Stability and strength of surface soil structural aggregates was examined. Surface soils were examined for the presence of fine and very fine roots. Water repellency was evaluated by observing the depth and thickness of a water repellent horizon in surface soils where it exists, and the length of time a water drop remained beaded on the surface. Soils were assessed in the field to determine if there is an increased risk of erosion. Soil survey maps were used to assist in making predictions of areas with the greatest risk of erosion.

3. Watershed response:

On-the-ground field observations and aerial reconnaissance within and downstream of the burn areas were conducted to determine the potential for high runoff response. Channel morphology related to transport and deposition processes were noted, along with channel crossings and stream outlets. Observations included condition of riparian vegetation and the volume of sediment stored in channels and on slopes that could be mobilized. Burn severity and changes in soil infiltration were also considered.

C. Findings

Several fires are not discussed in the findings because they were not identified as posing substantial threats to human life, property or critical cultural or natural resources. Those fires are: Tabor Creek, Stag, Mile Marker 367, North Delano, Sheep, Buffalo, Coyote, Dunphy, Hot Lake and Ranch.

Tabor Creek

The only area of concern in the Tabor Creek fire is two tributaries to Pole Creek. Pole Creek is perennial where these tributaries flow into it. The average annual precipitation for this area ranges from 11 to 14 inches.

Burn Severity: The majority of this fire burned at low severity. Pole Creek and some of its tributaries burned with moderate severity. South facing slopes also burned with moderate severity.

Burn Severity	Acres	Percent
High	0	0
Moderate	165	2
Low	7,439	98
Total	83,673	

Soils: Mountain slopes range from 15-50 percent. Soils range from gravelly loam to very gravelly loam. The soils are moderately drained to well drained. Permeability is slow to very slow and runoff is rapid. Potential erosion from water is moderate. Potential erosion from wind is slight. Fan piedmont remnants range from 4-15 percent. Soils range from very gravelly loam to gravelly silt loams. These soils are well drained. Permeability is slow to very slow and runoff is medium. Potential erosion from water and wind is slight. These soils are made up of Hydrologic Group C and Group D. Group C Soils have slow infiltration rates and slow rates of water transmission. Group D soils have very slow infiltration rates and slow rates of water transmission. The soils after the fire were not hydrophobic.

Watershed Response: Increase in soil erosion hazard is expected to be minimal because

of the low intensity and mosaic pattern of the burn. Only 2 % of the fire burned at a moderate severity. The loss of vegetation to slow runoff and prevent erosion may cause an increase in overland flow and soil erosion. Tributaries to Pole Creek pose the greatest risk of soil erosion because of pre-existing grazing pressure. These drainages are downcut and have very erosive banks. Watershed seedings are proposed for these drainages to speed revegetation.

Values at Risk: Pole Creek is Class III, moderately significant. It is a perennial stream at the confluence of these watersheds, but becomes intermittent soon afterward. Tributaries to this stream burned at moderate severity.

Roads in this area are used frequently. Potential flooding and debris flows pose a threat to life.

Sheep Creek Fire

The areas of concern in the Sheep Creek fire is the Battle Creek drainage and upper Sheep Creek drainages. Elevations for this fire ranged from approximately 4517 to 7276 feet. Slopes ranged from 2 to 50 %. The average annual precipitation range from 7 to 12 inches.

Burn Severity: The Sheep Creek fire burned at low severity for the majority of the fire. Burn severity was high for Battle Creek drainage and moderate for Sheep Creek and some of its tributaries.

Burn Severity	Acres	Percent
High	12	0.02
Moderate	986	1.18
Low	82,675	98.8
Total	83,673	

Soils: Mountain slopes range from 4 to 50 % with elevations from 5700 to 7000 feet. Soils range from gravelly loam to cobbly loam. Permeability is slow and runoff ranges from slow to rapid. Potential erosion from water ranges from slight to moderate. Potential erosion from wind is slight. Foothill slopes range from 15 to 50 % with elevations from 5000 to 6000 feet. Potential erosion from water ranges from moderate to severe. Potential erosion from wind is slight. Fan piedmont remnants slopes range from 2 to 8 % with elevations from 4500 to 5500 feet. Soils are very fine sandy loams. Permeability is moderately slow to moderate and runoff is medium. Potential erosion from water and wind ranges from slight to moderate. These soils are made up of Hydrologic Group B, C and D. The soils after the fire were not hydrophobic.

Evidence of past large debris flows were observed in the lower drainage of Battle Creek.

Watershed Response: Only about 1.2% of this fire burned at moderate or high severity. The drainages which burned at moderate to high severity may have increased runoff and soil erosion due to the loss of soil cover. Increase in soil erosion hazard is expected to be minimal because the majority of the burn was low severity. A low severity burn will leave sufficient litter and vegetation to intercept raindrops and slow runoff. South and west facing slopes were very steep but the hydrologic component was not altered by the loss of vegetation because rocks and outcrops make up a large percentage of soil cover.

Values at Risk: Battle Creek drainage and Sheep Creek drainage may experience soil loss due to moderate to high burn severity.

Battle Creek drainage has a well used road that runs up it which is used by Sierra Pacific Power Company and the public. The potential runoff and debris flows pose a threat to life.

Coyote

The Coyote fire burned 11,778 acres. Elevations in the Coyote fire range from 6,070 to 8,202 feet. Slopes range from 2-75%. The average annual precipitation is 12 to 15 inches. The majority of the fire is drained by Beaver Creek.

Burn Severity: The majority of the Coyote fire was low burn severity. Moderate burn severity occurred primarily in intermittent tributaries, swales and on some side slopes. High burn severity occurred mostly in the perennial drainages. Beaver Creek and Little Beaver Creek in particular experienced high burn severity.

Burn Severity	Acres	Percent
High	287	2
Moderate	740	6
Low/Unburned	10,645	92
TOTAL	11,672	

Soils: Soil information is derived from the Soil Survey of Tuscarora Mountain Area, Nevada. Most of the burn occurs within five soil map units. The northeast portion of the fire is low dissected terraces and strongly sloping to moderately steep uplands. Soils are shallow to very deep and well drained. Hazard of erosion due to water is moderate to high and hazard of erosion due to wind is slight to moderate. These soils have a very

slow rate of infiltration. Soils tested in the northeast area of the burn were moderately to strongly hydrophobic. The remainder of the fire occurs on steep to very steep mountainsides with slopes ranging from 30 to 75%. Soils are deep to very deep and well to excessively drained. Hazard of erosion due to water is moderate to high. Hazard of erosion due to wind is slight. Infiltration rates are moderate. Soils tested in this area of the burn were not hydrophobic with the exception of the Little Beaver Creek drainage where soils were weakly hydrophobic at the ash-soil interface.

On an aerial reconnaissance it was observed that the steep mountainsides along Beaver and Little Beaver Creeks were actively eroding. Large fans occurred at the mouth of intermittent tributaries along Beaver Creek indicating high pre-fire rates of erosion.

Watershed Response: With 92% of the Coyote fire experiencing low burn severity, overall watershed response is expected to be low. Areas of moderate to high burn severity occurred mostly in intermittent and perennial drainages. Runoff response will be slightly higher in the bottoms of these drainages. A low burn severity fire will consume vegetation above the soil surface but leave sufficient vegetation and litter on the ground to intercept raindrops and aid in infiltration. Vegetation is expected to recover completely within one year of a low severity fire.

Beaver Creek is the main drainage within the burn. Beaver Creek has a high sediment load and is adjusting laterally. The result is that the stream is cutting into the steep mountainsides and terraces and large amounts of sediment are being deposited into the channel. Having experienced high burn severity within the riparian zone, Beaver Creek will be less able to accommodate its traditional flows and its high sediment load due to almost complete consumption of the riparian vegetation. The channel is expected to continue to adjust laterally at a slightly faster rate than pre-fire conditions.

Portions of Beaver Creek have incised. Where incision has occurred and tributaries enter the stream gullies have formed. Water entering Beaver Creek through these moderate and high burn severity tributaries will runoff at a slightly faster rate and will further erode the existing gullies and may cause headcuts to move upward.

Values at Risk: Beaver Creek and its perennial tributaries are historical Lahontan Cutthroat Trout (LCT) habitat. Lahontan Cutthroat Trout are a threatened species. Increases in sediment load will cause the channel to aggrade and increase its width-depth ratio resulting in higher stream temperatures. Complete consumption of riparian vegetation along Beaver Creek will also result in higher temperatures due to lack of cover. Initial ash flows will elevate pH levels in the perennial streams temporarily. (See Wildlife Assessment for further description.)

Buffalo

The Buffalo Fire burned a total of 21,188 acres. Elevations range from approximately

5,369 feet to 7,400 feet above mean sea level (AMSL).

Burn Severity: The majority of the Buffalo fire was low severity. There was some moderate severity in the center of the fire and a drainage in the northeast corner of the fire. Frazier Creek had moderate to high burn severity throughout the drainage, although there were sections of unburned aspen and willow stands. The upper watershed of Frazier creek was moderate severity.

Burn Severity	Acres	Percent
High	252	1
Moderate	853	4
Low/Unburned	20,083	95
TOTAL	21,188	

Soils: Mountain slopes range from 4 to 40 percent with elevations from 6,000 to 7,500 feet AMSL. Soil include stony loam, very gravelly, extremely gravelly loam and cobbly loam. These soils are shallow and well drained. Potential erosion from water ranges from slight to moderate and potential erosion from wind is slight. Hill slopes range from 15 to 50 percent with elevations from 5,500 to 7,000 feet AMSL. Soil includes very gravelly loam and cobbly loam. These soils are shallow to moderately deep and well drained. Potential erosion from water ranges from moderate to high. Potential erosion from wind is slight. Fan piedmont remnants slopes range from 2 to 15 percent with elevations from 5,000 to 5,500 feet AMSL. Soil include loams, cobbly loams and gravelly loams. These soils are moderately deep and well drained. Permeability is moderately slow to moderate and runoff is medium. Potential erosion from water and wind are slight. The soils after the fire were not hydrophobic.

Watershed Response: The watershed response is expected to be low because 95% of this fire was low burn severity. Most of the areas which burned at moderate and high severity were within Frazier Creek drainage and its tributaries. Runoff response will be slightly higher in these drainages. The low severity burns should recover quicker than the moderate and high severity areas.

Portions of Frazier Creek experienced high burn severity. At these locations, there was very little soil structure and root mass and cut banks were breaking off and falling into the stream. High sediment and ash loads are expected to be delivered to the stream after the first runoff event. The burning of riparian vegetation will limits this streams ability to handle spring runoff and higher flows until the vegetation is reestablished.

Values at Risk: Frazier Creek is a historical Lahontan Cutthroat Trout (LCT) habitat.

Lahontan Cutthroat Trout are a threatened species. Increases in sediment load will cause the channel to aggrade and increase its width-depth ratio resulting in higher stream temperatures. Complete consumption of riparian vegetation along Frazier Creek will also result in higher temperatures due to lack of cover. Initial ash flows will elevate pH levels in the perennial streams temporarily. (See Wildlife Assessment for further description.)

Ranch

The Ranch fire burned 18,966 acres. Elevations in the Ranch fire range from 4,560 to 6,234 feet. Slopes range from 0-50%. The average annual precipitation is 10 inches.

Burn Severity: The Ranch fire experienced different burn severities in its southwest and northeast areas. The southwest portion of the burn is nearly level to gently sloping topography.
The fire appears to have moved quickly through this area and did not have a significant effect on soil conditions and therefore, hydrologic function. This area experienced low burn severity. The northeast portion of the burn experienced mostly moderate burn severity. High burn severity occurred primarily in swales and intermittent tributaries in the northeast area. Jakes Creek, a perennial stream, also experienced high burn severity.

Burn Severity	Acres	Percent
High	132	<1
Moderate	7,597	40
Low/Unburned	11,237	59
TOTAL	18,966	

Soils: Soil information is derived from the Draft Report Soil Survey of Humboldt County East Part, Nevada. The northeast area of the burn that experienced moderate and high burn severity occurs within one soil map unit. This map unit occurs on volcanic flowrock plateaus. Soils are shallow to deep. Hazard of erosion due to water ranges from slight to high and hazard of erosion due to wind is slight. These soils have slow to very slow rates of infiltration. Soils tested in this area of the burn were weakly hydrophobic just below the soil surface.

Watershed Response: Watershed response is expected to be moderate to high on the northeast portion of the Ranch fire. In the southwest portion of the fire, which experienced low burn severity, watershed response will be similar to pre-fire conditions. In the northeast portion of the fire increased runoff and sediment will be transported

through intermittent drainages that experienced high burn severity. It was observed on a field reconnaissance that those particular drainages also stored significant amounts of sediment available for delivery downstream. The main unnamed drainage in this area of the burn is a gully that will be very susceptible to increased water and sediment yields.

Values at Risk: The main drainage in the northeast portion of the fire will experience increased water and sediment yield. Large amounts of sediment in tributary channels are available for movement downstream. If there is a large storm event, soil will move off site and the existing gully in the main tributary will further erode. There will be a loss of short- and long-term soil productivity.

Mile Marker 367

The Mile Marker 367 fire burned 578 acres. Elevations in the Mile Marker fire range from 6,100 to 8,200 feet. Slopes range from 4 to 50%. Average annual precipitation ranges from 8 inches at the lower elevations to 18 inches at the highest elevations.

Burn Severity: The Mile Marker fire had primarily high burn severity, associated with the dense pinyon-juniper stands. Some of the lower elevation areas with fewer trees had moderate burn severity.

Burn Severity	Acres	Percent
High	445	77
Moderate	133	23
TOTAL	578	

Soils: Soil information came from the Elko County Soil Survey Southeast Part, NV (766), unpublished. Soils in the higher elevations of the burn occur on 30 to 50% slopes. These soils comprise a little more than half of the burned area, and occur on the eastern portion of the burn. They are shallow soils over limestone that have high percentages of coarse fragments and are medium textured. Runoff is rapid on these soils. Water erosion hazard is moderate and the wind erosion hazard is slight.

A recent field inspection of the burn following a small rainfall, estimated at 0.1 inches, revealed a large runoff event occurred with significant soil movement. Rill erosion is present on some of the steep side slopes, also. Some of the steep side slopes had little or no understory, leaving nothing to hold the soil in place after the trees burned.

Approximately 100 acres occurring in the middle of the burn has soils that are shallow to moderately deep over limestone and dolomite. Rock outcrop occurs over approximately 15 percent of the area. These soils are very gravelly and medium textured. Runoff is

rapid and the water erosion hazard is moderate to high. Recent and historic soil movement was evident during the field inspection of these soils. Wind erosion hazard is slight.

The small area of soils occurring on fan remnants at lower elevations on 4 to 15 percent slopes are either shallow over a duripan or petrocalcic (cemented calcium carbonate layer) horizon. Textures are typically gravelly loams. These soils have slight to moderate water erosion hazard and slight wind erosion hazard.

The soil loss tolerance, T factor, on these shallow soils is only one ton per acre per year. The T factor is the maximum annual amount of erosion that can occur on soils before they permanently lose productivity. These soils have a high risk of exceeding the one ton per acre of soil erosion because there is no vegetation nor roots left to hold the soil together and curb runoff. Soil loss rates that were calculated on the same soils, approximately one mile south of the burn as part of the Pittston project, ranged from 0.57 to 0.96 tons/acre/year using USLE. The loss of litter and vegetative canopy from the fire would cause the soil loss values to increase over the T levels. The trees will not be fully reestablished for about one hundred years.

Watershed Response: The watershed response is expected to be high because 77% of this fire has high burn severity, the slopes are very steep, and the burned wooded slopes had little understory. Fire severity in the center of the burn, south of the road, is high. Most of the rest of the fire had moderate burn severity. The greatest hydrologic response is expected from the steep slopes that that had high burn severity. This area formerly supported a dense stand of pinion and juniper trees.

Values at Risk: Although the downstream values are not significant, the loss of soil from the steep slopes, possibly down to bedrock, that supports a dense stand of pinyon and juniper forest resources, cannot be replaced for thousands of year.

Pittston Well is located downstream in sec.20 and is at slight risk of being buried by sediment should an intense precipitation even occur. The proposed erosion control and vegetative treatments should reduce the risk of this occurring.

This area is popular with recreationists and the road that goes through the burn is used by motorcyclists. Some off highway vehicle erosion was noted in the burn during the field inspection. Large runoff events would make this problem worse, and mud and debris flows could make the area inaccessible to recreationists. Flood flows would be a safety concern to recreationists in this area.

Stag

The Stag fire burned 19,555 acres. Elevations range from approximately 6,000 to 7,800 feet. Precipitation ranges from 11 inches at the lower elevations to 15 inches on the mountain tops. Slopes are 4 to 50%.

Burn Severity: The majority of the Stag fire had moderate burn severity. High burn severity occurred along Indian Creek and its ephemeral tributary drainages and a few spots along, and tributary, to Conners Creek. Most of the east side had low burn severity.

Burn Severity	Acres	Percent
High	997	5
Moderate	13,283	68
Low/Unburned	5,276	27
TOTAL	19,555	

Soils: Soil information came from the Soil Survey of Elko County, Nevada, Central Part. Most of the burn occured within five soil mapping units. Soils in the very northern tip of the burn formed in residuum and colluvium from rhyolite. They range from shallow to deep and are gravelly or very gravelly on the surface. They have slow to moderate permeability and rapid runoff. The wind erosion hazard is slight and the water erosion hazard is moderate on slopes greater than 15 percent and slight on slopes less than 15 percent. Small gullies occur along the old two track road. These soils primarily had moderate burn severity with some low on the east side. There were no signs of hydrophobicity

The most extensive soil map unit occurs on mountains on 15 to 50 percent slopes. These soils are located in the southwestern portion and northern half of the burn. Depth ranges from shallow to deep over rhyolite. Textures range from loam to clay and there is a high gravel and cobble content throughout the soils. Runoff is rapid, and the water erosion hazard is primarily moderate. Wind erosion hazard is slight, although some areas of active wind erosion were observed following the burn in areas that had few surface coarse fragments. Numerous gullies and incised channels were observed during the field examinations, this was particularly evident along an old jeep trail where there were few surface coarse fragments. The old vehicle tracks had eroded into gullies. This area is proposed for treatment with approximately 38 straw bale check dams to prevent excessive amounts of sediment from reaching Conners Creek. Another area with a large gully extends from Conners Creek in section 34 northwest to a road in section 33. A watershed seed mix is proposed to treat this gully. Three other areas of concern occur along lower Conners Creek and would be treated with aspen erosion mat to reduce runoff, sheet erosion, and bank erosion into Conners Creek. Soils along the drainageways in the southern part of the burn along Indian Creek and its tributaries, had high burn severity. These drainages would be treated with a watershed seed mix to reduce gully erosion and sediment loads into Indian Creek. These soils did any signs of hydrophobicity, however, even where all the vegetation was completely consumed by fire.

Similar soils are found south of Conners Creek and on the east half of the burn. They

occur on crests and side slopes of hills and also formed from colluvium or residuum from rhyolite. Slopes are predominantly 4 to 15% , but there is a smaller component that occurs on 15 to 50 % side slopes. Soils located on slopes less than 15% are shallow over rhyolite. Soils on the steeper slopes are moderately deep over bedrock. Textures range from loam to clay with a high gravel and or cobble content. Runoff is medium and wind and water erosion hazard are slight, however, bank sloughing along lower Conners Creek was widespread.

Soils south of Conners Creek, on the west side of the burn, occur on mountains on 8 to 50 percent slopes. They are shallow to deep over bedrock. Runoff is medium to rapid. Textures are very gravelly loams to clay loams, and permeability is moderately slow. Water erosion hazard is slight on slopes less than 30 percent, and moderate on greater than 30 percent slopes. Wind erosion hazard is slight.

The last soil association occurs to the east of Indian Creek in the southern part of the burn. These soils are shallow over rhyolite. They have loamy surface textures and loam to clay subsoils with very high gravel contents throughout the soil profile. Runoff is rapid and permeability is very slow to moderately slow. The wind erosion hazard is slight and the water erosion hazard is slight to moderate for these soils.

Watershed Response: Since most of the Stag fire had moderate burn severity, the watershed response is expected to be moderate with a few exceptions. Much of the Indian Creek watershed that burned occurred on steep rocky slopes that had high burn severity along the drainages. The soils are in hydrologic soil groups C and D, which means they will have a high runoff response, especially when the vegetation has been removed.

Values at Risk: Conners Creek is a perennial Lahontan Cutthroat Stream that is located almost entirely within the area that burned in the Stag Fire. Post fire impacts such as increased pH, turbidity, temperature, and suspended solids could threaten fish populations. Some of the stream banks are unstable and increased runoff from the burn could cause further bank sloughing.

Indian Creek, a perennial stream on the southern end of the burn, burned with high severity. Much of the steep watershed above it has rocky soils with high runoff potential. The loss of vegetation along the floodplain would cause future increases in sediment load and erosion.

Another area of concern is along the northern portion of the burn. Several drainages have their confluence near a culvert by the Itcaina Ranch. The fire burned right up to the ranch house. Higher than normal runoff from the burned area would be expected following precipitation events which may threaten the culvert. The proposed drill and aerial seedings would reduce the risk of both culvert washout and flood damage to the county road near the ranch house.

Bailey

The Bailey fire burned 1,201 acres. Elevations in the Bailey fire range from 5,200 to 6,000 feet. Precipitation ranges from 9 to 12 inches annually.

Burn Severity: All of the Bailey fire had moderate burn severity.

Burn Severity	Acres	Percent
Moderate	1,201	100
TOTAL	1,201	

Soils: Soils that occur on alluvial fans and upland terraces on 4 to 30% slopes occupy approximately 65% of the burned area.. They developed from mixed rock and loess with a volcanic ash component. Soils on slopes less than 15 percent are generally deep and have fine sandy loam textures. The soils on slopes greater than 15 percent are shallow over tuff, and also have fine sandy loam textures. Runoff is medium and the water erosion hazard is slight on the less sloping areas and high on the steep slopes. Wind erosion hazard is moderate to high.

Soils that occur on the high alluvial terraces comprise approximately 20 percent of the burned area. They developed in mixed alluvium with some loess that is high in volcanic ash or in alluvium from tuff. These soils are moderately deep and occur on 2 to 15 percent slopes. Surface texture is gravelly loam and the subsoil is clay. An indurated silica cemented hardpan occurs at a depth of approximately 25 inches. These soils have slow to moderately slow permeability and medium runoff. The wind and water erosion hazards are moderate when the soils are disturbed.

Soils along and paralleling Trout Creek are deep and medium textured, commonly containing gravel and cobble. They also developed in loess with a high volcanic ash content. These soils have moderately slow to moderately rapid permeability. Runoff is slow. The water erosion hazard is slight, however, Trout Creek's streambanks are actively eroding. The wind erosion hazard is slight to moderate when the soils are disturbed. Grazing should be avoided until the vegetation is fully reestablished to prevent excessive erosion. These soils represent approximately 15% of the burned area.

The proposed seeding and livestock closure on public land should prevent excessive accelerated erosion from occurring, unless a large precipitation event occurs before the vegetation becomes reestablished.

Watershed Response: Increased local runoff would be expected with accompanying bank sloughing and soil erosion on the south side of Trout Creek. This section of Trout Creek has burned twice in the last two years. Active erosion has been noted on all the

visits to the BLM water quality site that is located here. Limited fire size and gentle to moderate slopes would keep this impact localized.

Values at Risk: Trout Creek is a perennial stream that supports Lahontan Cutthroat Trout/Rainbow Trout hydrids. The first few storm events would wash ash into Trout Creek which would elevate the pH temporarily. Increased runoff, and accompanying sediment, could reduce fish and other aquatic species populations. Trout Creek is also tributary to Pine Creek, and then the Humboldt River, which is an impaired water for violations of total phosphorus, turbidity, and iron.

North Delano

The North Delano Fire burned 8,824 acres. Elevations in the Delano Fire range from approximately 5,200 to 6,800 feet. Average annual precipitation is 10 to 14 inches.

Burn Severity: More than half of the North Delano Fire had moderate burn severity, with the remainder being nearly equally high and low severity.

Burn Severity	Acres	Percent
High	**1,769**	**20**
Moderate	**4,826**	**53**
Low/Unburned	**2,229**	**25**
TOTAL	**8,824**	

Soils: Soils in the northern half of the fire, that is proposed for seeding, are primarily shallow soils over rhyolite, tuff, or limestone bedrock. They have high gravel and cobble contents when they occur on greater than 15% slopes. On gentle slopes there are few coarse fragments. Surface textures include loamy fine sand, silt loam, sandy loam, and loam. Subsoils are predominantly loams and clay loams. Runoff is rapid and permeability is very slow to moderately rapid. Wind erosion hazard is slight, except on the gentle slopes where there are few surface coarse fragments. Water erosion hazard varies from slight to high.

Soils in the southern half of the burn occur on mountain slopes, mountain valley fan remnants, hills and rock pediment remnants. Mountain soils are shallow over limestone and have a very high volume of gravel, cobble and stone. They have silt loam and loam textures and moderate permeability. The wind erosion hazard is slight and the water erosion hazard is moderate to high.

Soils on hills and rock pediment remnants are shallow over bedrock or moderately deep over a hardpan. Textures range from loamy sand to clay loam. On steep slopes soil have high surface cobble content, and on gentle slopes there are few, if any, coarse fragments. These soils occur on gentle to steep slopes and have medium to rapid runoff. Permeability is slow to moderately rapid. Wind and water erosion hazard is slight. No active rill or gully erosion was found on these soils during the post fire reconaisance flight. Although nearly all the vegetation burned completely in some of the wooded areas, the soils were not hydrophobic when tested in the field. Some pedastaling was observed which is an indicator of sheet erosion.

Soils on mountain valley fan remnants are moderately deep over a hardpan or deep over bedrock. Small amounts of gravel may be present in these soils. Textures range form loam to clay.

Watershed Response: The areas that high burn severity in the wooded areas in the northwest and southwest portions of the burn would have a high watershed response. Increased runoff, sheet erosion and soil pedastalling may occur following rain.

Values at Risk: Higher than normal runoff events can be expected following precipitation, especially from wooded areas. There is a threat to the Rock Spring area, which is located to the west of the fire, from several actively eroding drainages. Increased runoff could cause further erosion and deposition along the county road. The other concern is the road crossing at Little Goose Creek to the northwest of the burn. Damage to the creek and road crossing caused by increased traffic during the fire and water drafting from the creek, has created a large pool of water that is in need of repair. Increased runoff from the burned area coming down the drainages to this crossing will make the problem worse.

V. RECOMMENDATIONS

A. Emergency Stabilization-Fire Suppression Rehabilitation

None

B. Emergency Stabilization

Situation: A small rain, estimated at 0.1 inches, that occurred shortly after the Mile Marker 367 Fire, caused extensive soil movement and rilling. The Mile Marker Fire burned on steep slopes that were densely wooded with pinyon and juniper trees. Most of the fire had high burn severity, and there is little vegetation or litter remaining to slow runoff and trap sediment. Soils are shallow, and little soil can be lost before the soil loss tolerance factor is exceeded.

Recommendation: Emergency directional instream tree felling, and contour log terraces

should be installed along the drainages and slopes with high burn severity before the next precipitation event. The proposed contour tree felling and log erosion barriers would greatly reduce overland and in channel flow, thereby reducing the amount of runoff and potential to initiate rilling and downstream mud and debris flows. It would reduce slope lengths and provide logs to trap some of the sediment and debris. (See Specification — Instream directional tree felling and Contour log felling).

C. Rehabilitation

Situation: High burn severity areas have lost vegetation and ground cover. These areas are expected to experience increased runoff and erosion.

Recommendation: Aerially seed moderate to high burn severity drainages in Beaver Creek and Little Beaver Creek in the Coyote fire, intermittent tributaries in the Ranch fire, intermittent tributaries in the Tabor Creek fire, Battle Creek and intermittent drainages in the Sheep fire, Frazier Creek and intermittent drainages in the Buffalo fire to provide short- and long-term vegetative cover to reduce water yield and sedimentation. (See Specification #13: Watershed Protection Seeding)

Situation: In high burn severity areas where vegetation was consumed by the fire organic litter was consumed. Increased water and sediment yield is expected to occur.

Recommendation: Apply straw mulch to high severity burn areas where soils are well drained, occurring on gentle slopes and are protected from the wind. Mulch will slow runoff and help to prevent erosion. Topsoil will be protected and soil moisture will be maintained to promote biological activity in the soil. (See Specification #10: Bale Bombing.)

Situation: Aerial seedings and straw mulching are proposed on several high burn severity drainages to slow runoff and prevent erosion.

Recommendation: Monitor to ascertain aerial seeding and straw mulching success and to ascertain watershed conditions. If aerial seedings and mulch are not successful and watershed conditions deteriorate, prompt treatment should be prescribed and implemented. (See Specification #11: Monitor Success of Watershed Protection Seeding (Aerial) and Mulched Areas.)

Situation: Large amounts of sediment and runoff are expected to reach Conners Creek in the Stag Fire potentially threatening Lahontan Cutthroat Trout populations.

Recommendation: Install Aspen erosion mat along streambanks that are susceptible to sloughing and above the stream to trap sediment and reduce runoff. (See Specification #?, Aspen Erosion Mat).

Situation: Large amounts of sediment and runoff are expected to reach Conners Creek in

the Stag Fire potentially threatening Lahontan Cutthroat Trout populations.

Recommendation: Install straw bale check dams on three drainages above Conners Creek where an old jeep trail is actively eroding, and the banks of Conners Creek are unvegetated and unable to trap sediment. (See Specification # ?, Straw Bale Check Dams).

Situation: Water quality and soil loss problems are expected due to high severity burns in steep watersheds.

Recommendation: Monitor water quality to determine if the fires may negatively impact LCT streams at Conners Creek within the Stag Fire, at Beaver Creek within the Coyote Fire, at Frazier Creek within the Buffalo Fire, and Trout Creek within the Bailey Fire. Soil loss may occur as rill, sheet or gully erosion within these watersheds. Flow and sediment loads will be calculated for these watersheds and a watershed within Mile Marker 367. (See Specification # : Monitoring Severe Watershed Conditions).

Situation: Place flood hazard warning signs near narrow drainages where possible mud and debris flows may pose a threat to life and property.

Recommendation: Place flood hazard warning signs near Pole Creek in the Tabor Fire, at Battle Creek drainage in the Sheep Fire.

Situation: Soils with expected accelerated wind and water erosion rates need to be stabilized as soon as possible to prevent threats to public safety and unnecessary loss of soil resources.

Recommendation: Aerially or drill seed areas to stabilize soils. The primary benefit can be for range or wildlife resources and the secondary benefit to stabilize the watershed. These treatments are proposed on Bailey, North Delano, Stag, Sheep, Mile Marker 367, Ranch, Buffalo, Rodeo Creek, Hot Lakes, and Tabor Creek Fires

D. Management Recommendations (Non-Spec)

V. CONSULTATIONS

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